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INSECTS IN RELATION  
TO  
NATIONAL DEFENSE

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Circular 9

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LICE

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May 1941



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## INTRODUCTION

Lice become numerous and a general pest wherever groups of individuals are associated under conditions where strict cleanliness is not maintained. Infested individuals are always about, and care must be taken to prevent spreading and establishment of the lice they harbor.

These parasites annoy man and are vectors of serious diseases. Typhus fever, relapsing fever, and trench fever are louse-borne to man. Fortunately louse-borne typhus and relapsing fevers are not widespread in the continental United States and tropical America.

Lice found on man feed by sucking blood. They insert their mouthparts and attach for from 3 to 10 minutes. Extreme irritation occurs during and after feeding, and much discomfort results from scratching and loss of sleep. Long-continued infestations may cause chronic irritation and coloring of the affected skin.

## KINDS OF LICE

Man is attacked by sucking lice only. They are: the head louse (Pediculus humanus humanus L.); the body louse, or "cootie" (Pediculus humanus corporis Deg.); and the pubic louse, or "crab" louse (Phthirus pubis (L.)).

Geographically, human lice are found in all climates from the Arctic to the Tropics.

Human lice do not breed on animals other than man. Gorillas, apes, monkeys, dogs, cats, cattle, hogs, and horses have their own species, and do not maintain colonies of lice which may infest man.

### IDENTIFICATION

If there is doubt as to what kind of louse is encountered at any time, it is suggested that specimens be sent to the Bureau of Entomology and Plant Quarantine, U. S. Department of Agriculture, Washington, D. C., for examination by a specialist. Lice may be forwarded in small vials containing 70% (ordinary rubbing) alcohol, carefully packed, and labeled with name of collector, locality and date of collection, and animal from which taken.

### BIOLOGY

All lice have three stages: egg, larva, and adult. The larva, or immature form, is similar to the adult, but smaller and lighter in color. Louse eggs are called "nits." The length of time for completion of a life cycle varies according to the species and conditions of temperature and humidity. Human lice best carry on their life processes under conditions similar to those found on the human body.

#### Head Lice

Head lice are found chiefly among the hairs of the head where they may be seen as whitish or gray insects (fig. 1) which move rapidly when disturbed. The females are slightly larger than the males, sometimes attaining a length of  $1/8$  of an inch. They have been reported from other hairy parts of the body, also. After feeding they may be seen more readily





Figure 1 - Head louse, female. Figure 2 - Body louse, female.



Figure 4 - Egg of head louse on a hair.

Figure 3 - Pubic louse, male.

Figure 5 - Egg of pubic louse on a hair.



because of the darker color which is visible through their body covering. At oviposition, the female louse securely cements each egg to a hair (fig. 4); sometimes oviposition occurs in hats. Lice congregate in the hair at the back of the head and behind the ears. An infested head may be recognized by the general distribution of "nits," accompanied in serious cases by matted hair and scabby scalp.

The egg stage of the head louse varies from 5 to 10 days; 7 days is the usual period at about 90° to 96° F. Eggs are laid at the rate of 3 to 9 each day under normal conditions; a single female lays from 200 to 300 eggs in a lifetime. The length of time required for development from hatching until the mature louse is ready to oviposit averages about 10 days. Adult head lice, fed intermittently, live as long as 38 days, with an average of 27 days; but continual access to a source of blood would undoubtedly make these figures vary.

### Body Lice

Body lice, or "cooties," when mature, are gray, rapidly moving insects, sometimes reaching 1/6 of an inch in length, (fig. 2). They are found chiefly on clothing where it comes in contact with the body, such as underclothing close to the body, and on the outside of outer clothing to some extent, such as suspenders, pocket openings, etc. Stragglers may be found on the body. Eggs are laid chiefly in the seams and folds of clothing (fig. 6), preferably woolens and flannels, although cottons and silks are sometimes infested. Occasionally, eggs are found attached to hairs of the body, such as on the chest and in the armpits.

The biology of the body louse is similar to that of the head louse. The egg stage varies from 4 to 16 days at 79° to 98.6° F.; 8 days is the average when kept on the human body under normal conditions. Eggs are laid at the rate of from 3 to 14 daily, depending largely on whether feeding is interrupted or the

source of blood constantly available; 10 or 11 is the average number when lice can feed constantly. From 200 to 300 eggs are usually laid by one female in its lifetime. The length of time required from hatching until the mature louse is ready to oviposit averages 8 days when lice are kept on the human body under normal conditions. Adult body lice, fed intermittently, live as long as 46 days, with an average of 34 days. Unfed adults at 61° to 65° F. will live



Figure 6 - Eggs of body louse along seams of clothing.

as long as 7 days; at 98° they will live 3 days. Newly hatched lice die within 24 hours unless given access to food. Changes of temperature, as well as interrupted feeding, retard the life processes of body lice. A body louse has been observed to crawl about 1 yard in 2 minutes 43 seconds.

### Pubic Lice

Pubic lice, or "crab" lice (fig. 3), frequent the pubic region, armpits, body hairs, and in some cases are found in eyelashes, eyebrows, and have been reported from beards and mustaches. They are crab-like in form, with large, heavy legs that grasp hairs tightly and allow the insects to feed and cling close against the body. They are shorter and broader than the body louse. Eggs are laid on the hairs of that part of the body infested (fig. 5).

The egg stage of the pubic louse varies from 6 to 8 days under normal conditions; 16 to 18 days is required for development from the time of hatching until the mature louse is ready to oviposit. Under normal conditions a female was observed to lay 26 eggs. Adults and larvae die within two days after separation from their host. While on the host, they appear to feed almost constantly, and it is believed that such adults live somewhat less than a month. Pubic lice living on the host under normal conditions have been observed to move around in an area of less than an inch.

### DISSEMINATION

All three species are spread by physical contact with infested individuals, scattering of infested hairs, exchange of hats or clothing, or use of infested towels. Head and body lice move rapidly and so are capable of transferring from one host to another and of even infesting living quarters.

The optimum temperature for body lice is about 87° F., and when this temperature increases, the lice become agitated. This stimulates their activity so that they tend to leave healthy persons heated by exercise, or sick persons heated by fever. This tendency of lice to pass from fever patients to healthy persons is of importance in the spread of disease.



### CONTROL

Two problems are encountered in the control of human lice. The lice and eggs on the body must be eradicated as well as those in the clothing and equipment.

An efficient control system includes prevention of louse dissemination by not allowing individual infestations. Once lice are established, disinfection must be systematically undertaken. Treatment of living quarters, individuals, and equipment should be simultaneous. An efficient delousing plan involves the treatment of a man for lice on his body, while his clothing and equipment are disinfested nearby and are ready for him after he has bathed, shaved, and been deloused. Although lice are less prevalent in the United States than in many parts of the world, infestations are not infrequently encountered, and therefore systematic inspection, especially of new recruits, is important to prevent the establishment and spread of infestations in military units.

In the event that typhus or other louse-borne diseases are suspected, doctors and nurses should take adequate steps to prevent becoming infested. This danger is increased by the fact that lice are inclined to crawl away from patients with fever. It is recommended that garments be provided designed to exclude lice, including the use of rubber gloves extending over the sleeves of gowns.

#### Head Lice

Treatment of hair.--Close clipping of the hair facilitates head louse control, and many of the eggs and lice are thus removed. However, clipping the hair is not essential to control. Derris or cube powder containing 3% rotenone (the insecticidal principle) is effective when used as a dust or a wash.

The use of the material as a wash is more satisfactory in general because it insures thorough coverage. For this purpose is recommended a mixture of 5 level tablespoonfuls of derris or cube powder, 2 level tablespoonfuls of neutral soap, and 1 quart of warm water. The material is applied thoroughly to the hair and the surplus water taken up with a towel without rubbing the hair dry. The material should remain for at least 8 hours. In most instances, a single treatment of this kind will destroy all lice. The louse eggs, however, are not killed by the insecticide being brought in contact with them, and many people wash their heads soon after the treatment, thus removing the derris and allowing the nits to hatch. This necessitates a second application about 10 days after the first.

When the dust treatment is used, a salt cellar is very convenient for application. Place the proper dose of powder in a clean salt cellar, then work over the head, parting the hair with one hand and shaking into the part a small quantity of powder. Where the entire dose is applied, gently massage the entire head with the fingers of both hands. A level teaspoonful of powder is sufficient for a short-haired person and should be left in the hair for 48 hours before being washed out.

Other treatments recommended are:

1. Equal parts of kerosene oil and olive oil applied to the hair and scalp at night and washed out the following morning with warm water and soap.

2. Equal parts of kerosene oil and vinegar. Apply thoroughly to the head and cover with a towel for half an hour; then wash the following morning.

3. A 10 percent solution of larkspur is applied by means of a large towel, soaked and wrapped like a turban around the head and kept on six or eight hours overnight.

Eggs are not killed or removed by the insecticides used to kill the lice; therefore it is necessary to remove them with a fine-toothed comb. Hot vinegar tends to loosen the cement fastening the eggs to the hairs. Apply vinegar liberally to the head and then wrap the head in a bath towel wrung out of hot water and keep this on for an hour.

Treatment of hats.--Hats may be treated by methods recommended for clothing under "body lice" (p. 11).

### Body Lice

Treatment of body.--Body treatment in the case of body lice consists of thorough bathing in warm water with liberal use of soap. Liquid soap made in accordance with the following formula is recommended: Boil 1 part of soap chips in 4 parts of water, then add 2 parts of kerosene. This jellies when cold. To use, take 1 part of this soap jelly to 4 parts of warm water. Rub to a good lather and leave lather on the body for 15 minutes before washing off.

Finely ground derris or cube powder containing 2 or 3% rotenone is highly effective against the lice in all stages except the egg. It should be dusted lightly on the body, but more especially on the seams of the clothing at points frequented by the pests. The persistent use of this powder should ultimately eliminate an infestation. The frequency of application depends upon the exposure to infestation, frequency of bathing and changing clothing, and whether the powder is found to irritate the particular individual.



Those exposed to lice can secure much protection against becoming infested by dusting the body and clothing with this material. A shaker can is convenient for applying the powder.

If the derris or cube contains more than 3% rotenone it should be diluted with talc.

A powder which has been widely used against body lice is known as NCI. The formula follows:

Naphthalene	96%
Creosote	2%
Iodoform	2%

This powder is sprinkled freely on the body and in the clothing. It may be irritating and is not recommended for use around the public region.

Two other powders that have been recommended are:

- |     |             |          |
|-----|-------------|----------|
| (1) | Talc        | 20 grams |
|     | Naphthalene | 1/2 gram |
|     | Iodoform    | 1/2 gram |
|     | Creosote    | 1 cc.    |
- 
- |     |          |          |
|-----|----------|----------|
| (2) | Talc     | 20 grams |
|     | Sulphur  | 1/2 gram |
|     | Creosote | 1 cc.    |

The former is said to be cheaper, drier, and less irritating; the latter six times as effective as NCI, less irritating and drier.

Treatment of clothing.--Clothing and equipment are treated by several methods: dry heat, hot water, steam, chemicals, fumigation, storage, or a combination of methods.

Dry heat. Exposure to dry heat at 140° F. for 20 minutes kills lice in all stages. Ovens or chambers for this purpose may be so constructed that clothes may be hung up and treated with the least amount of damage or wrinkling. Some measure of control is effected by the ordinary ironing processes. All stages of lice are killed in dry heat in 1 minute at 159° F. Dry heat is recommended for leather, felt, rubber, or webbing fabrics, but is considered harmful to woolen materials.

Hot water. Hot water at 150° F. for 5 minutes is effective in killing all stages of lice. Cotton, linens, or silks may be treated in this manner, or they may be immersed in water at 212° F. for 1 minute. Leather, felt, rubber, or webbing fabrics are damaged by hot water treatments. Woolens, unless especially handled, are liable to undue shrinkage. Pierce, Hutchison, and Moscovitz worked on this problem in 1919 and recommended the usual laundry processes, which follow:

"1a. In the washer run a current of live steam fifteen minutes, revolving cylinder every five minutes, and discharging water of condensation every five minutes. Remove the garments and shake until almost dry. This requires only a few shakes.

"1b. Submerge in water at 165° F. for twenty minutes without motion, except a few revolutions every five minutes.

"2. Wash 15 minutes at 131° F. in heavy suds and light load.

"3. Rinse three times, three minutes each, at 131° F.

"4. Extract.

"5. Run in tumbler fifteen minutes at a minimum of 140° F.

"We advise live steam (1a) or very hot soaking (1b) only in cases where there is no heated tumbler (5) available, or where the garments are suspected of being contaminated with very resistant spore-bearing bacteria.

"In other words, we recommend the usual laundry methods for the disinfection and disinsection, because of their added value of cleansing.

"There can be no doubt that the ordinary processes of the laundry will kill all lice and their eggs, and probably all insect life."

Steam. Live steam in a steam chamber at 259° F. for 10 minutes will kill eggs and active stages of lice. When a barracks bag or roll of infested clothing was exposed to steam under pressure, so that a temperature of 167° F. was produced in the center of the roll, all eggs and lice were killed. Eggs are killed in moist heat in 10 seconds at 159° F.

Portable sterilizers and Serbian barrel-type delousing units have been successfully used as steam chambers.

Leather, felt, rubber, and webbing materials are damaged by steam, but woollens are little affected and shrinkage is negligible when clothing is properly handled. However, steam is said to fix certain stains, such as bloodstains.

Chemicals. Cresol solutions have been recommended for infested articles which may be damaged by other methods. A 5 percent solution in water may be used as a wash, or materials may be immersed for 30 minutes in a 2 percent solution at 100° F.

Fumigation. Fumigation is recommended for killing all stages of body lice. Three materials are commonly used:

1. Hydrocyanic acid gas. This is poisonous and should be used with extreme care by experienced operators. The standard dosage for lice is 1 lb. of cyanide to 1,000 cu. ft. of space (see Cir. 22).

2. Carbon disulphide. Clothing may be deloused by using carbon disulphide in a tight container such as a chest or can. The carbon disulphide is put in a shallow open pan on top of the loosely packed clothing. As the liquid evaporates, the resulting gas which is heavier than air flows downward into all parts of the enclosed space. Use carbon disulphide at the rate of 1 pound to 1,000 cu. ft. of space, and then keep the container tightly closed for 24 hours. Carbon disulphide is highly inflammable and explosive and no fire or open flame should be near while the gas is being used (see Cir. 22).

3. Chloropicrin, one of the tear gases, is extremely toxic to insects and also to man. The irritation to man's eyes, nose, and throat, however, is a warning of its presence. If used as directed, chloropicrin is non-explosive and non-inflammable. It is highly penetrating, but fumigated clothing may be worn after an airing of 3 to 5 minutes. Chloropicrin will not injure leather goods, but will affect rubber, and if used without impurities of chlorine and nitrogen peroxide, will not bleach colored fabrics. Chloropicrin is used as a fumigant in the same manner as carbon disulphide. It should be used only by experienced operators. Heat is used to expedite evaporation and penetration. This may be applied to the fumigation chamber as a whole so that the temperature is about 90° F. A convenient method of applying heat is by heating water in flasks, or by placing hot stones or bricks among the clothing in a chest. One quart of water at 180° F. is required for each cubic foot of space. At these temperatures lice and



eggs may be killed within thirty minutes with 1 ounce of liquid chloropicrin used for each 7 cubic feet of space (see Cir. 22).

Storage. Lice can live without food for 10 days at a temperature of 40° F.; and at a temperature of 85° F. they can live only 2 or 3 days. To make sure that infested garments are free from living lice they should be kept in storage for 30 days. This will destroy by starvation all active lice placed in storage and give time for the eggs to hatch and newly hatched larvae to die. Care should be taken not to place additional infested clothing with material already in storage, for this would allow reinfestation.

Natural means. In the absence of equipment for thorough delousing, exposure of clothing to extreme heat or cold may be utilized in reducing louse infestations. Spreading infested clothing in the sun in hot climates will destroy all lice in a few hours, and similar exposures to zero temperatures will do likewise. Another method of reducing the number of body lice by natural means is to expose infested garments to predacious ants, such as fire ants.

Treatment of infested quarters.--Bedding should be given the same treatment as clothing, or hung up out of doors for a period of 2 to 3 weeks. Floors and walls, especially cracks, should be sprayed with 3 to 5 percent cresol, or the infested building should be fumigated with hydrocyanic acid gas; the latter is the most effective remedy and will also kill all other forms of insect life which may be in the house. As previously mentioned, however, this is a very deadly poison, and in cases where its use is decided upon, it is best to employ an experienced fumigator to make the application (see Cir. 22).

### Pubic Lice

Treatment of body.--Pubic, or "crab" lice, may be destroyed with derris or cube powder or ointment. The ointment is made by thoroughly mixing 1 part by volume of derris or cube powder (200 mesh, 4 to 5% rotenone) in 10 parts of petrolatum. It is applied lightly to the affected parts.

The use of the powder is more satisfactory because it is so easily distributed by means of a shaker can. A very light, but well distributed, application repeated a second time after a lapse of 10 days will eliminate an infestation. The powder is slightly irritating to some people. It may be washed off after remaining on overnight.

Light infestations in the eyelashes and eyebrows can usually be dealt with by removing the lice and eggs with a fine pair of forceps; however, derris ointment can be used. Care must be taken not to get this material in the eyes as it causes irritation and swelling.

Mercurial ointment is often used on the infested parts to kill crab lice. It is poisonous, however, and should not be used too freely or over too much of the body at one time.

Eggs may be removed by shaving the infested portions or by softening the cement with which the eggs are attached to the hairs with warm vinegar and rubbing them off.

Treatment of clothing.--Clothing is not so readily infested with pubic lice as with body lice. Precautions should be taken, however, against "stragglers" and dislodged hairs bearing lice and eggs. Treatment of clothing should be carried out as under section on body lice (p. 11).



Treatment of infested quarters.--Living quarters are not likely to become infested with public lice. Bedding should be attended to the same as clothing (p. 11) because it may become infested.

## REFERENCES

- Bacot, A. ----- 1917 -- A Contribution to the Bionomics of Pediculus humanus (vestimenti) and Pediculus capitis. Parasitology, v. 9, no. 2, pp. 228-258.
- Buxton, Patrick A. --- 1939 -- The Louse. Edward Arnold & Co., London, 115 pp.
- Dunn, Lawrence H. ---- 1923 -- Bathing and Delousing American Troops at Brest, France, Prior to Their Embarkation for the United States. The Military Surgeon, pp. 1-7.
- Foster, M. H. ----- 1918 -- Carbon Tetrachloride Vapor as a Delousing Agent. U. S. Public Health Reports, Reprint 489, pp. 1823-1827.
- Hutchison, R. H. and - 1919 -- Studies on the Dry Cleaning Process as a Means of Destroying Body Lice. Proceedings of the Ent. Soc. of Washington, v. 21, no. 1, pp. 8-20.
- Pierce, W. D.

- Hutchison, R. H. ----- 1919 -- Experiments with  
Steam Disinfectors  
in Destroying Lice  
in Clothing.  
Journal of Para-  
sitology, v. VI,  
pp. 65-78.
- Moore, W. and ----- 1919 -- An Investigation  
Hirschfelder, A. D. of the Louse  
Problem. Research  
Publications, Univ.  
Minnesota, Minnea-  
polis, v. 8, no. 4,  
86 pp.
- Nuttall, G. H. F. ---- 1917 -- The Biology of Pedicu-  
lus humanus. Para-  
sitology, v. 10,  
no. 1, pp. 80-185.
- Nuttall, G. H. F. ---- 1918 -- The Biology of Phthirus  
pubis. Parasitology,  
v. 10, no. 3, pp.  
383-405.
- Nuttall, G. H. F. ---- 1918 -- Combating Lousiness  
Among Soldiers and  
Civilians. Para-  
sitology, v. 10,  
no. 4, pp. 411-  
586.
- Pierce, W. D. ----- 1921 -- Sanitary Entomology.  
pp. 301-329.  
Richard G. Badger,  
Boston.
- Pierce, W. D. and ---- 1919 -- Government Report on  
others Laundry Machinery,  
Its Adaptability  
to Various Require-  
ments of Disinfec-  
tion and Disinsec-  
tion. National  
Laundry Journal,  
Chicago, v. 81,  
no. 1, pp. 4-14.
-